

CLAIMS

1. A method of performing an anastomosis, comprising:
juxtaposing two blood vessels to be anastomosed using an juxtaposition device, to a
5 desired configuration in which at least one vessel is an end vessel;
applying an adhesive to said vessels while they are in said configuration, said adhesive
being sufficient to ensure both sealing and bonding of said two vessels to each other; and
removing said juxtaposition device after said adhesive sufficiently sets.
- 10 2. A method according to claim 1, wherein juxtaposing comprises engaging at least one of
said vessels using said juxtaposition device
3. A method according to claim 1, wherein juxtaposing comprises inserting at least a
portion of said juxtaposing device into at least one of said vessels.
- 15 4. A method according to claim 1, wherein juxtaposing comprises inserting at least a
portion of said juxtaposing device into a wall of at least one of said vessels.
5. A method according to claim 1, wherein juxtaposing comprises juxtaposing by
20 manipulating said juxtaposing device.
6. A method according to claim 5, wherein juxtaposing comprises pulling at least one of
said vessels using said juxtaposing device.
- 25 7. A method according to claim 1, wherein juxtaposing comprises juxtaposing said
vessels to have substantially no space between the vessels at an anastomotic location thereof.
8. A method according to claim 7, wherein juxtaposing comprises juxtaposing said
vessels to have a sealed contact therebetween.
- 30 9. A method according to claim 1, wherein juxtaposing comprises providing at least one
of said vessels using a graft delivery system and wherein said juxtaposition device is coupled
to said graft delivery system.

10. A method according to claim 1, wherein applying an adhesive comprises applying an adhesive to said juxtaposition device.
- 5 11. A method according to claim 1, wherein applying an adhesive comprises not applying an adhesive to said juxtaposition device.
12. A method according to claim 1, comprising drying an anastomosis area of said blood vessels using a stream of air, prior to said applying.
- 10 13. A method according to claim 1, comprising assisting a setting of said adhesive.
14. A method according to claim 13, wherein said assisting comprises blowing air on said adhesive.
- 15 15. A method according to claim 14, wherein said air is heated.
16. A method according to claim 1, wherein applying comprises mixing an adhesive from at least two components during a process of flowing said adhesive during said applying.
- 20 17. A method according to claim 1, wherein applying comprises applying using at least one nozzle.
18. A method according to claim 1, wherein applying comprises applying using a plurality of nozzles arranged in a ring.
- 25 19. A method according to claim 1, wherein applying comprises applying into a mold adjacent said anastomosis area, which mold shapes the adhesive about said area.
- 30 20. A method according to claim 1, wherein applying comprises into a form adapted to inhibit spillover.

21. A method according to claim 1, wherein applying comprises applying a pre-measured amount of adhesive.
22. A method according to claim 1, wherein applying comprises applying as a continuous
5 flow.
23. A method according to claim 1, comprising removing some of said adhesive after said applying.
- 10 24. A method according to claim 1, wherein said removing comprises removing after said adhesive sets completely.
25. A method according to claim 1, wherein said removing comprises removing before said adhesive sets completely.
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26. A method according to claim 1, wherein said removing comprises removing as soon as said adhesive starts to set.
27. A method according to claim 1, wherein said removing comprises removing before
20 said adhesive starts to significantly set.
28. A method according to claim 1, wherein said applying comprises applying while blood flows in at least one of said blood vessels.
- 25 29. A method according to claim 1, wherein no foreign materials other than said adhesive remain in said anastomosis.
30. A method according to claim 1, comprising providing at least one strengthening element in said anastomosis and leaving said at least one strengthening element permanently in
30 said anastomosis.
31. A method of performing an anastomosis, comprising:
attaching at least a first scaffold element to a first blood vessel;

attaching at least said first scaffold element or a second scaffold element to a second blood vessel;

positioning said blood vessels using said at least a first scaffold element, to a desired configuration;

5 applying an adhesive to said vessels while they are in said configuration, said adhesive being sufficient to ensure both sealing and bonding of said two vessels to each other; and removing said at least first scaffolding element.

10 32. A method according to claim 31, wherein said first blood vessel is a side vessel.

33. A method according to claim 31, wherein said first blood vessel is an end vessel.

34. A method according to claim 31, comprising mechanically attaching said at least first scaffolding element to said first blood vessel.

15 35. A method according to claim 34, wherein mechanically attaching comprises piercing.

36. A method according to claim 34, wherein mechanically attaching comprises hooking.

20 37. A method according to claim 31, comprising adhesively attaching said at least a first scaffolding element to said first blood vessel.

38. A method according to claim 37, comprising adhesively attaching using a tacky adhesive.

25 39. A method according to claim 31, comprising attaching a second scaffolding element to said second blood vessel.

30 40. A method according to claim 31, wherein a same first scaffolding element is attached to both of said blood vessels.

41. A method according to claim 31, wherein said at least one scaffolding element comprises a plurality of wires adapted to engage a blood vessel.

42. A method according to claim 31, wherein said at least one scaffolding element comprises a shunt.

5 43. A method according to claim 31, wherein said at least one scaffolding element comprises a balloon.

44. A method according to claim 31, wherein positioning comprises direct manual positioning.

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45. A method according to claim 31, wherein positioning comprises positioning by manipulating said at least one scaffolding.

46. A method according to claim 31, wherein positioning comprises positioning said
15 vessels to have substantially no space between the vessels at an anastomotic location thereof.

47. A method according to claim 31, wherein applying an adhesive comprises applying an adhesive using a port coupled to said at least one scaffolding element.

20 48. A method according to claim 31, wherein applying an adhesive comprises applying an adhesive into a form which shapes said adhesive about said configuration.

49. A method according to claim 31, comprising blowing air on said adhesive to aid setting.

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50. A method according to claim 31, wherein removing comprises removing said at least one scaffolding element after said adhesive sets.

51. A method according to claim 31, wherein removing comprises removing at least one of
30 said at least one scaffolding elements before said adhesive sets.

52. Apparatus comprising:
an adhesive source;

at least one adhesive delivery port;

at least one blood vessel holder adapted to stabilize said port relative to an anastomosis area of two blood vessels.

5 53. Apparatus according to claim 52, wherein said vessel holder is adapted to remain external to said vessels.

54. Apparatus according to claim 52, wherein said vessel holder is adapted to penetrate at least one of said vessels.

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55. Apparatus according to claim 52, wherein said vessel holder is adapted to penetrate both of said vessels.

15 56. Apparatus according to claim 52, wherein said vessel holder comprises a plurality of wires adapted to engage a blood vessel.

57. Apparatus according to claim 52, wherein said vessel holder comprises a vacuum source which applies vacuum to an outside of a vessel, thereby holding it.

20 58. Apparatus according to claim 52, comprising a rim adapted to inhibit spillover of adhesive.

25 59. Apparatus according to claim 52, wherein said apparatus defines a form between said apparatus and said blood vessels, for filling with adhesive and shaping a desired set adhesive configuration.

60. Apparatus according to claim 52, wherein said at least one delivery port comprises a plurality of ports adapted to be arranged around one of said vessels

30 61. Apparatus according to claim 52, wherein said at least one delivery port comprises a structure adapted to mix at least two components of an adhesive.

62. Apparatus according to claim 52, wherein said at least one delivery port comprises at least one nozzle attached to a first component source of adhesive and at least one nozzle attached to a second component source of adhesive.
- 5 63. Apparatus according to claim 52, comprising a source of gas adapted to be aimed at said anastomosis area.
64. Apparatus according to claim 63, comprising a heater for said gas.
- 10 65. Apparatus according to claim 52, comprising means for assisting setting of said adhesive.
66. Apparatus according to claim 52, comprising a setting sensor which provides an indication of setting of said adhesive.
- 15 67. Apparatus according to claim 52, comprising a setting timer.
68. Apparatus according to claim 52, comprising a controller which synchronizes an activation of said vessel holder and delivery of said adhesive.
- 20 69. Apparatus according to claim 68, wherein said controller is a mechanical controller using mechanical means to determine said synchronization.
70. Apparatus according to claim 68, wherein said controller is an electrical controller
25 using circuitry to determine said synchronization.
71. Apparatus according to claim 52, wherein said apparatus is mounted in a delivery capsule adapted to be attached to a delivery system and adapted to hold a graft vessel therein.
- 30 72. Apparatus according to claim 71, wherein said capsule includes a set amount of adhesive.

73. Apparatus according to claim 71, wherein said capsule includes a single external control.

74. Apparatus according to claim 52, wherein said vessel holder is arranged to be split after
5 use.

75. Apparatus according to claim 52, wherein said vessel holder includes a slot in a side thereof, adapted for placement of a vessel therein.

10 76. Apparatus according to claim 75, wherein said slot is fixed.

77. An adhesive anastomotic system, comprising:

a first blood vessel holder;

a second blood vessel holder adapted to interlock with said first blood vessel holder,

15 such that blood vessels held by said two vessel holders contact; and

an adhesive port configured to deliver an adhesive to said contact.

78. A system according to claim 77, wherein said vessel holders are configured to hold two vessels in an end-to-end configuration.

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79. Apparatus comprising:

an adhesive source;

at least one adhesive delivery port;

at least one vessel holder mechanically coupled to said delivery port and adapted to

25 stabilize said port relative to at least one blood vessel; and

an adhesive setting enhancer.

80. Apparatus according to claim 79, wherein said enhancer comprises a source of gas.

30 81. Apparatus according to claim 79, wherein said enhancer comprises a source of energy.